National Chiao Tung University
Dept. of Computer & Information Science
Intro. to Digital Systems, Spring 1998

June 5, 1998
Handout #15
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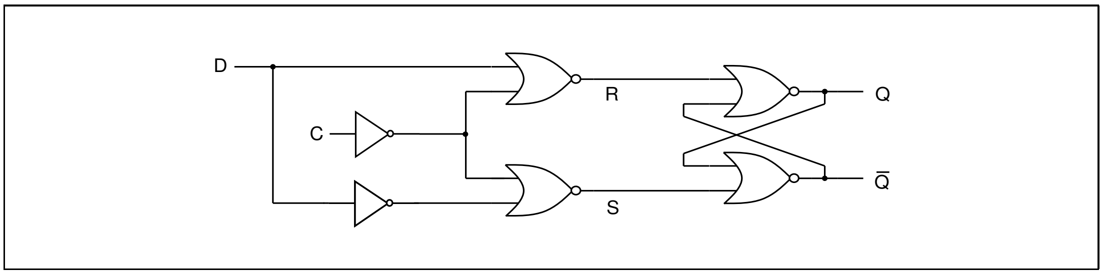
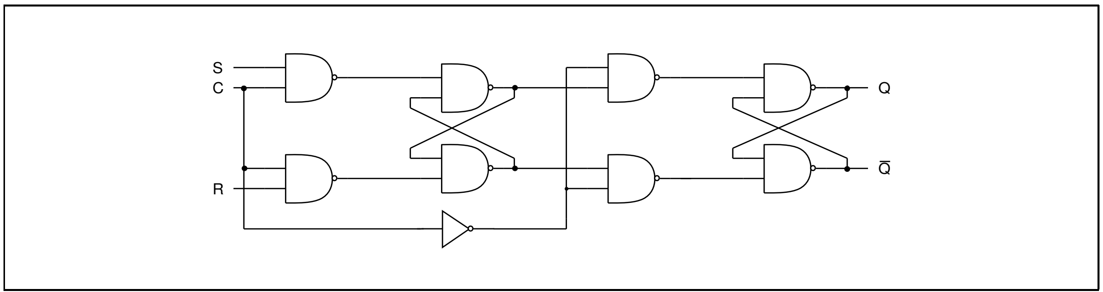
Simple Solutions to Homework #4

Problems 1–14 are adopted from M. M. Mano and C. R. Kime, *Logic and Computer Design Fundamentals*, Prentice-Hall, Inc., 1997.

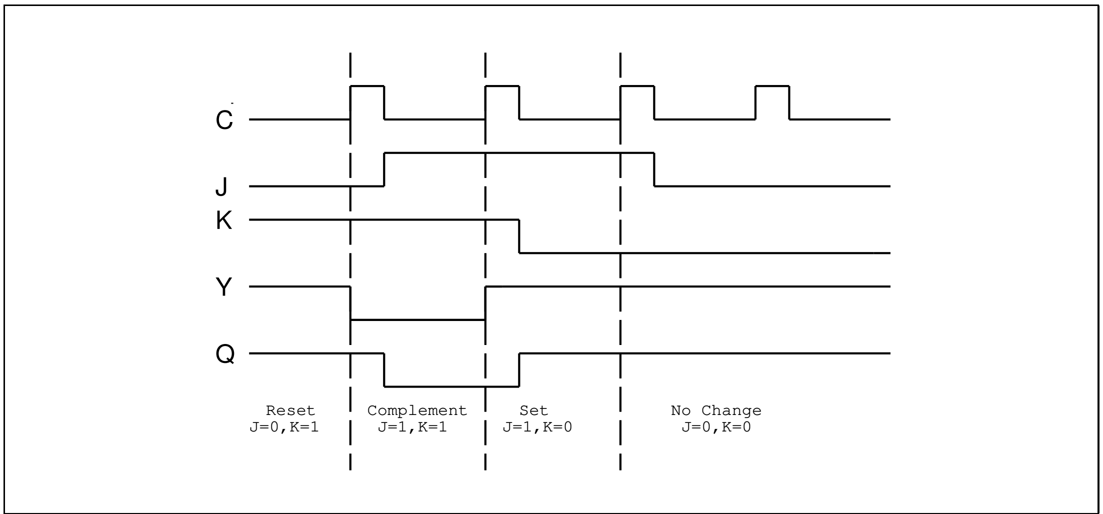
1. Problem 4-4 (page 215).



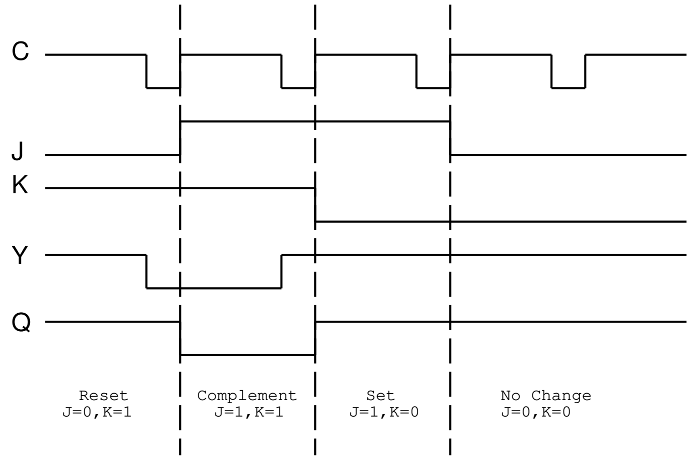
2. Problem 4-5 (page 215).



3. Problem 4-7 (page 215).

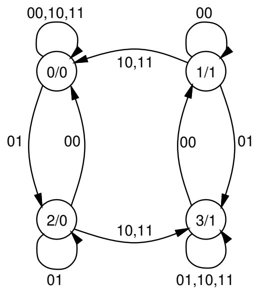


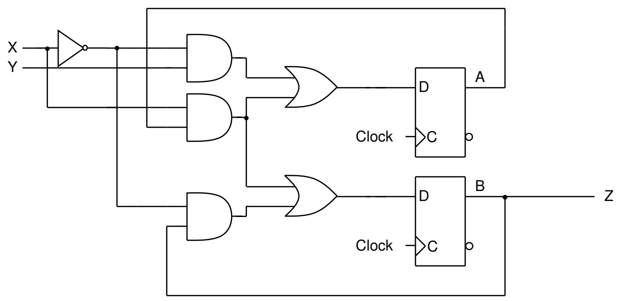
4. Problem 4-8 (page 215).



5. Problem 4-12 (page 216).

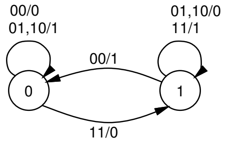
Present state		Inputs		Next state		Output
A	B	X	Y	A	B	Z
0	0	0	0	0	0	0
0	0	0	1	1	0	0
0	0	1	0	0	0	0
0	0	1	1	0	0	0
0	1	0	0	0	1	1
0	1	0	1	1	1	1
0	1	1	0	0	0	1
0	1	1	1	0	0	1
1	0	0	0	0	0	0
1	0	0	1	1	0	0
1	0	1	0	1	1	0
1	0	1	1	1	1	0
1	1	0	0	0	1	1
1	1	0	1	1	1	1
1	1	1	0	1	1	1
1	1	1	1	1	1	1





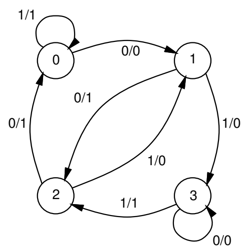
6. Problem 4-14 (page 216).

Present state	Inputs		Next state	Output
Q	X	Y	Q(t+1)	S
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	0
1	1	1	1	1



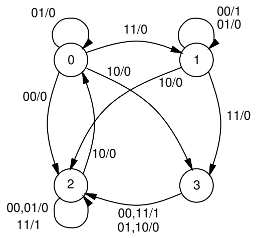
7. Problem 4-18 (page 217).

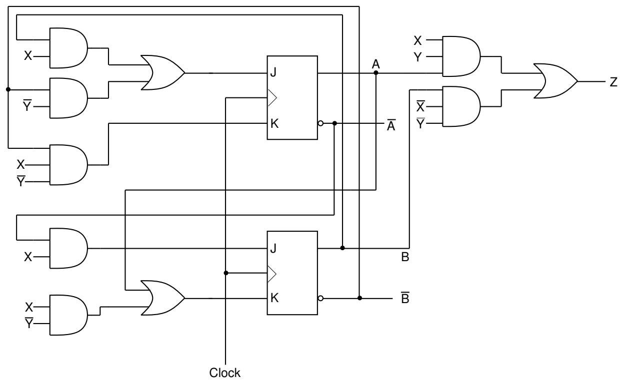
Present state		Input	Next state		Output
A	B	X	A	B	Y
0	0	0	0	1	0
0	0	1	0	0	1
0	1	0	1	0	1
0	1	1	1	1	0
1	0	0	0	0	1
1	0	1	0	1	0
1	1	0	1	1	0
1	1	1	1	0	1



8. Problem 4-19 (page 217).

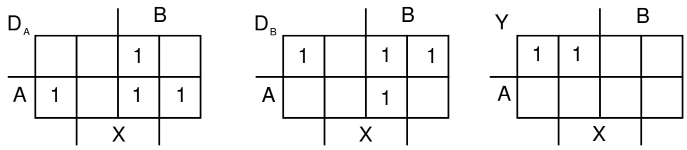
Present state		Inputs		Next state		Output
A	B	X	Y	A	B	Z
0	0	0	0	1	0	0
0	0	0	1	0	0	0
0	0	1	0	1	1	0
0	0	1	1	0	1	0
0	1	0	0	0	1	1
0	1	0	1	0	1	0
0	1	1	0	1	0	0
0	1	1	1	1	1	0
1	0	0	0	1	0	0
1	0	0	1	1	0	0
1	0	1	0	0	0	0
1	0	1	1	1	0	1
1	1	0	0	1	0	1
1	1	0	1	1	0	0
1	1	1	0	1	0	0
1	1	1	1	1	0	1





9. Problem 4-21 (page 217-218).

Present state A	Present state B	Input X	Next state A	Next state B	Output Y
0	0	0	0	1	1
0	0	1	0	0	1
0	1	0	0	1	0
0	1	1	1	1	0
1	0	0	1	0	0
1	0	1	0	0	0
1	1	0	1	0	0
1	1	1	1	1	0



$D_A = A\overline{X} + BX$ $D_B = \overline{A}\,\overline{X} + BX$ $Y = \overline{A}\,\overline{B}$

10. Problem 4-24 (page 218).

J	N	Q	
0	0	0	Reset
0	1	Q	No Change
1	0	$\overline{Q}$	Complement
1	1	1	Set

J=N=D	Q	
0	0	reset
1	1	set

11. Problem 4-25 (page 218).

Q(t)	Q(t+1)	J	N
0	0	0	X
0	1	1	X
1	0	X	0
1	1	X	1

12. Problem 4-27 (page 218).

Present state		Input	Next state		FF Inputs			
A	B	X	A	B	J_A	K_A	J_B	K_B
0	0	0	0	1	0	X	1	X
0	0	1	0	0	0	X	0	X
0	1	0	0	1	0	X	X	0
0	1	1	1	1	1	X	X	0
1	0	0	1	0	X	0	0	X
1	0	1	0	0	X	1	0	X
1	1	0	1	0	X	0	X	1
1	1	1	1	1	X	0	X	0

$J_A = BX$

$K_A = \bar{B}X$

$J_B = \bar{A}\,\bar{X}$

$K_B = A\,\bar{X}$

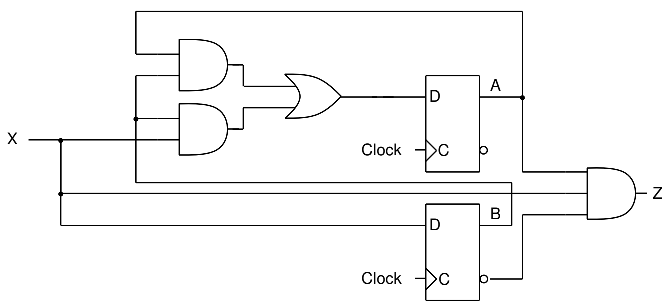
13. Problem 4-28 (page 218).

Present state		Input	Next state		Output
A	B	X	A	B	Z
0	0	0	0	0	0
0	0	1	0	1	0
0	1	0	0	0	0
0	1	1	1	1	0
1	0	0	0	0	0
1	0	1	0	1	1
1	1	0	1	0	0
1	1	1	1	1	0

$A(t+1) = AB+BX$

$B(t+1) = X$

$Z=A\bar{B}X$



14. Problem 4-33 (page 219).

Present state		Input	Next state		FF Inputs	
A	B	X	A	B	T_A	T_B
0	0	0	0	0	0	0
0	0	1	0	1	0	1
0	1	0	1	0	1	1
0	1	1	0	1	0	0
1	0	0	1	0	0	0
1	0	1	1	1	0	1
1	1	0	1	1	0	0
1	1	1	0	0	1	1

$T_A = ABX + \bar{A}B\bar{X}$

$T_B = AX + \bar{A}B\bar{X} + \bar{B}X$